

February 11, 2019

Edna G Steering Committee
C/O Dan Walker, City Administrator
City of Two Harbors
522 First Ave
Two Harbors, MN 55616

Re: Edna G Tugboat Relocation Options

AMI Project # 181014

This letter is written in regard to the progress of the feasibility study of the relocation of the Edna G. Tugboat which is currently located in Agate Bay in Two Harbors, MN. The purpose of the work is to determine the feasibility of relocating the Edna G Tugboat to a location out of the water for the long-term preservation of the vessel.

Work Completed

It was determined that the condition of the vessel's structure should be analyzed to ensure that moving, lifting, etc. can be performed without damaging the vessel or compromising the integrity of the hull. A site visit was performed on January 11, 2019 to determine the overall condition of the steel hull. The condition assessment was completed by taking Ultrasonic Thickness (UT) and Pit Depth measurements over the entire length of the ship.

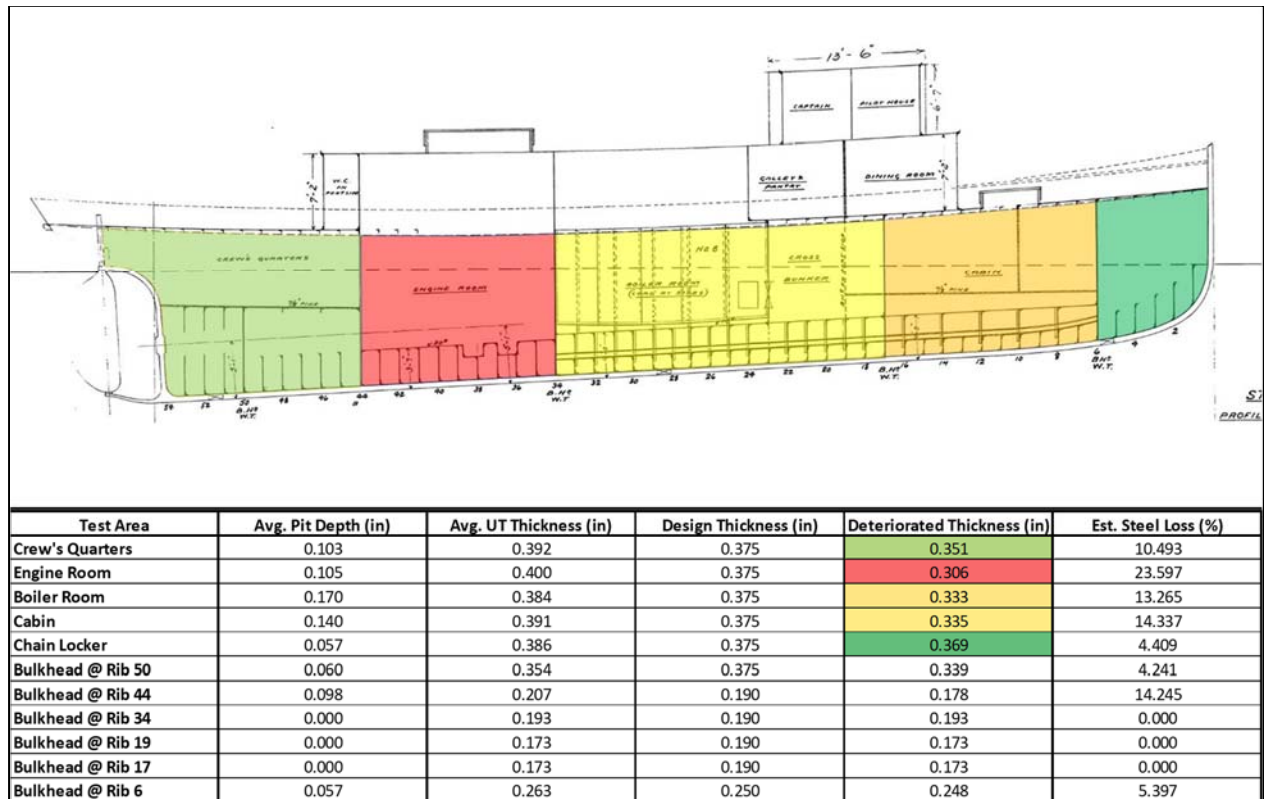


Image 1: Summary of Hull and Bulkhead Condition Data from Site Inspection 1

Historical drawings of the vessel were used for reference. It may be noted that the average UT readings were greater than the original design thickness. This is most likely due to manufacturing process and quality control practices of fabricating steel plates in the late 1800's. The thickness of the hull coating likely did not affect the UT measurements since consistent results were documented in the coated & uncoated areas of the hull. During the inspection, AMI also estimated the concentration of the pitting due to corrosion. The deteriorated steel thickness was determined from a weighted average of the steel loss due to the corrosion and the concretion of the pits.

The condition assessment findings were consistent with results from a previous assessment performed in 2013 by AMI. The interior coatings were found to be mostly intact and have prevented further deterioration of the vessel. Preliminary, it appears that the vessel could be moved or towed to another location in the water without damaging the hull. It is standard procedure to lock the rudder and screw of the towed vessel in position, to prevent any torque from being transmitted to the engine and/or jacking gear.

A model of a cross section of the Edna G has also been completed so Finite Element Analysis (FEA) could be completed. The FEA will be utilized to determine the effects of lifting the vessel from the water and potentially setting it on a cradle. The most significant deterioration was observed in the ship's Engine and Boiler Room. These sections also support the heaviest loads, so supporting this area is a concern. Placing one of the support cradles at this bulkhead (located at the 34th rib of the vessel) seems logical, if the vessel is to be placed permanently on land. Rib locations can be seen in the attached, original drawing of the vessel.

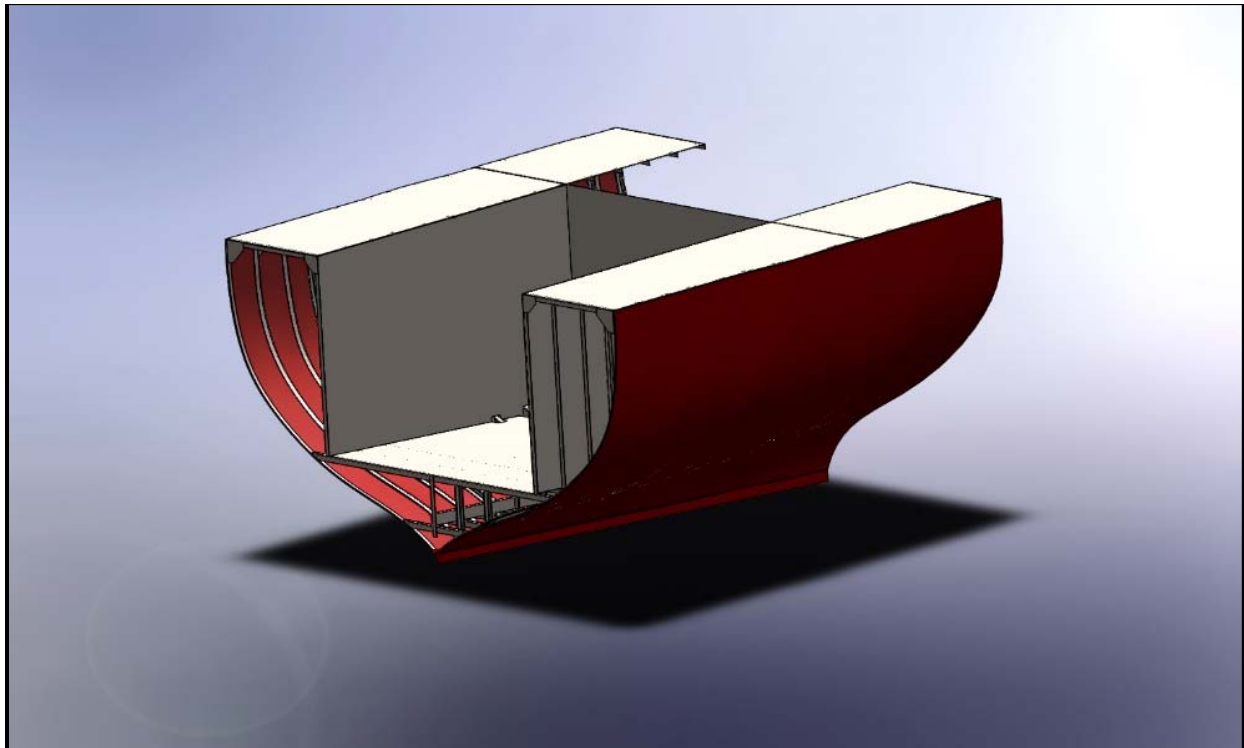


Image 2: Cross Section Model of Edna G. Tugboat

A rendered model of the vessel has also been created to aid in visualizing the proposed relocation options, when the time comes.



Image 3: Rendering of Edna G. Tugboat

Work Yet to be Completed

A preliminary list of options for means of moving the vessel to a new location as well as the requirements for each option has been completed. We have also compiled a list of unknowns that need to be answered to correctly set up the simulated load study, as well as a list of research items for evaluating site location options. Pricing will also be compiled for each of these options to be considered.

A second site inspection will be performed to ensure that loads are placed accurately in our simulations. The simulated analysis of the model will be performed following the second visit. This model will be quite valuable in moving forward with our research as well as with the preliminary cradle design.

The results of our inspections and the FEA testing will be brought to Fraser Shipyard for a consultation with their Naval Architect for discussion. This discussion should be helpful in determining what, if any, reinforcements of the hull are required, as well as an indication of what work should be done if the Edna G should remain in the water.

If you have any questions or comments please contact AMI at (715) 718-2193 extension 17.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read 'Chase Dewhirst'.

Chase Dewhirst, PE
Marine Engineering Manager

Enclosed:

- Edna G Profile & Deck Plan

